

# Role of human-earth system interactions in scenario and model development: A CMIP-focused discussion

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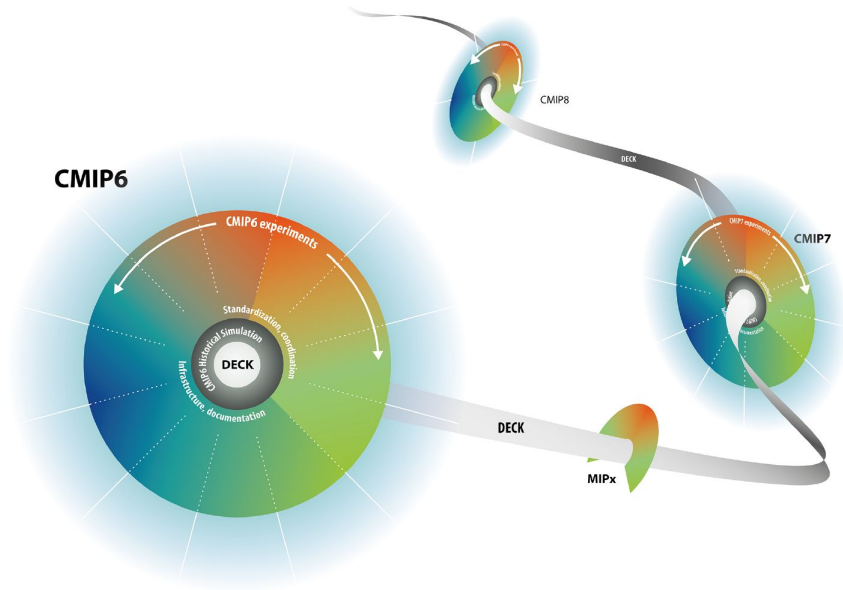


# Background on the Coupled Model Intercomparison Project (CMIP)

- **Objective:** to better understand past, present and future climate changes arising from natural, unforced variability or in response to changes in radiative forcing in a multi-model context.
- Started in 1995 -> first set **common** experiments: comparing the model response to an **idealized** forcing - a constant rate of increase which was accomplished using a CO<sub>2</sub> increase of 1% per year compounded.
- CMIP schedule has been tied to IPCC Assessment Reports, as results/papers from CMIP simulations have been used extensively in the ARs. A critical aspect to the success of CMIP is its **infrastructure** and **standards**

# CMIP6

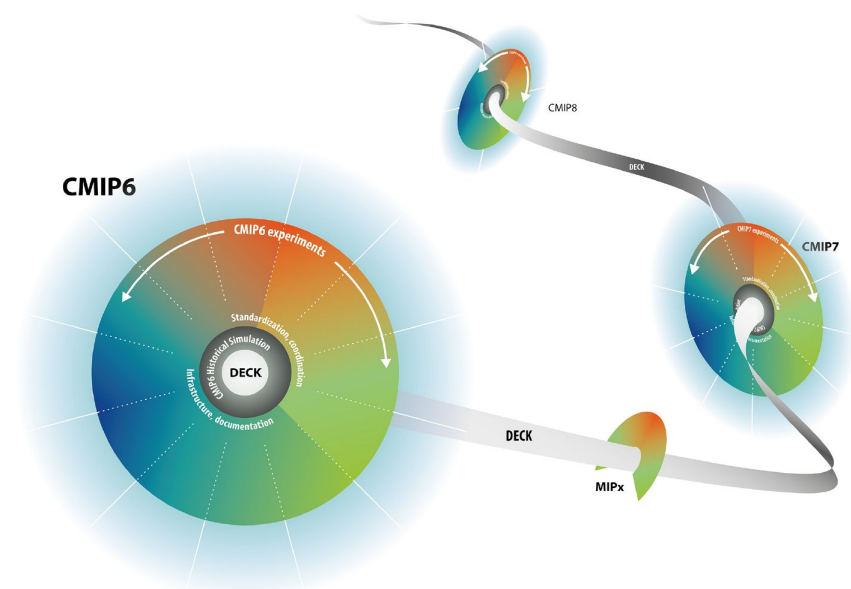
## Diagnostic, Evaluation, and Characterization of Klima (DECK)



- Pre-industrial control
- 1%CO2
- 4xCO2
- AMIP

Eyring et al. (GMD, 2016)

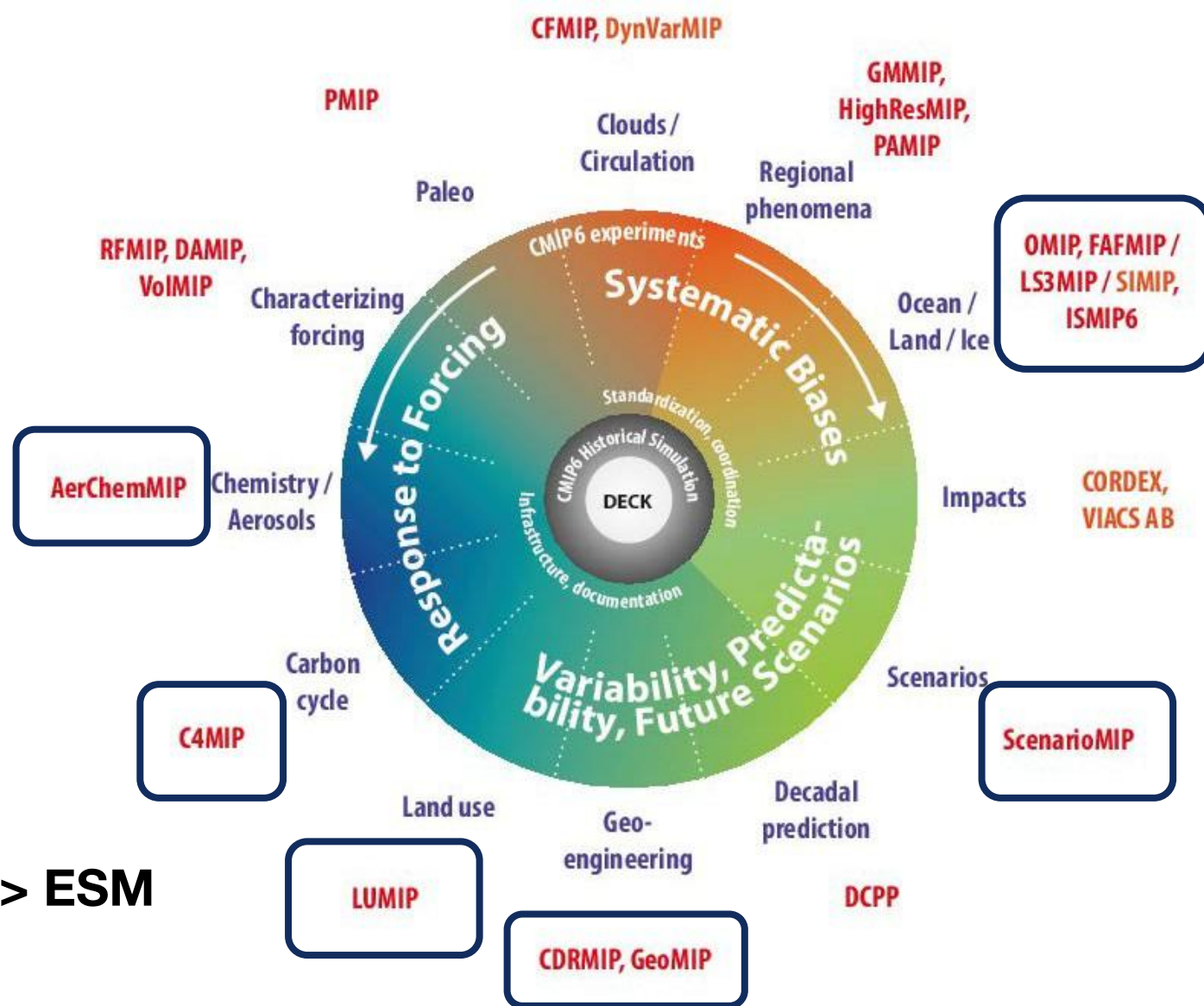
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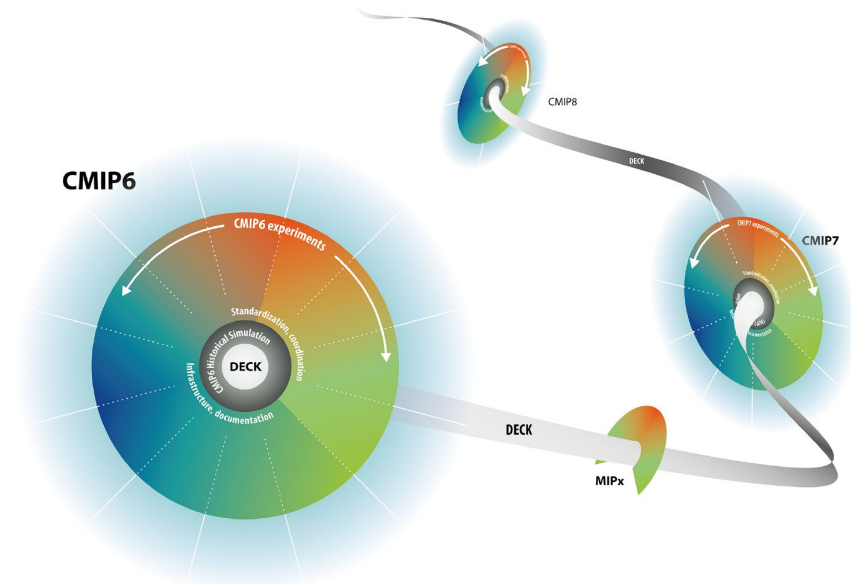
## CMIP6



**IAM -> ESM**



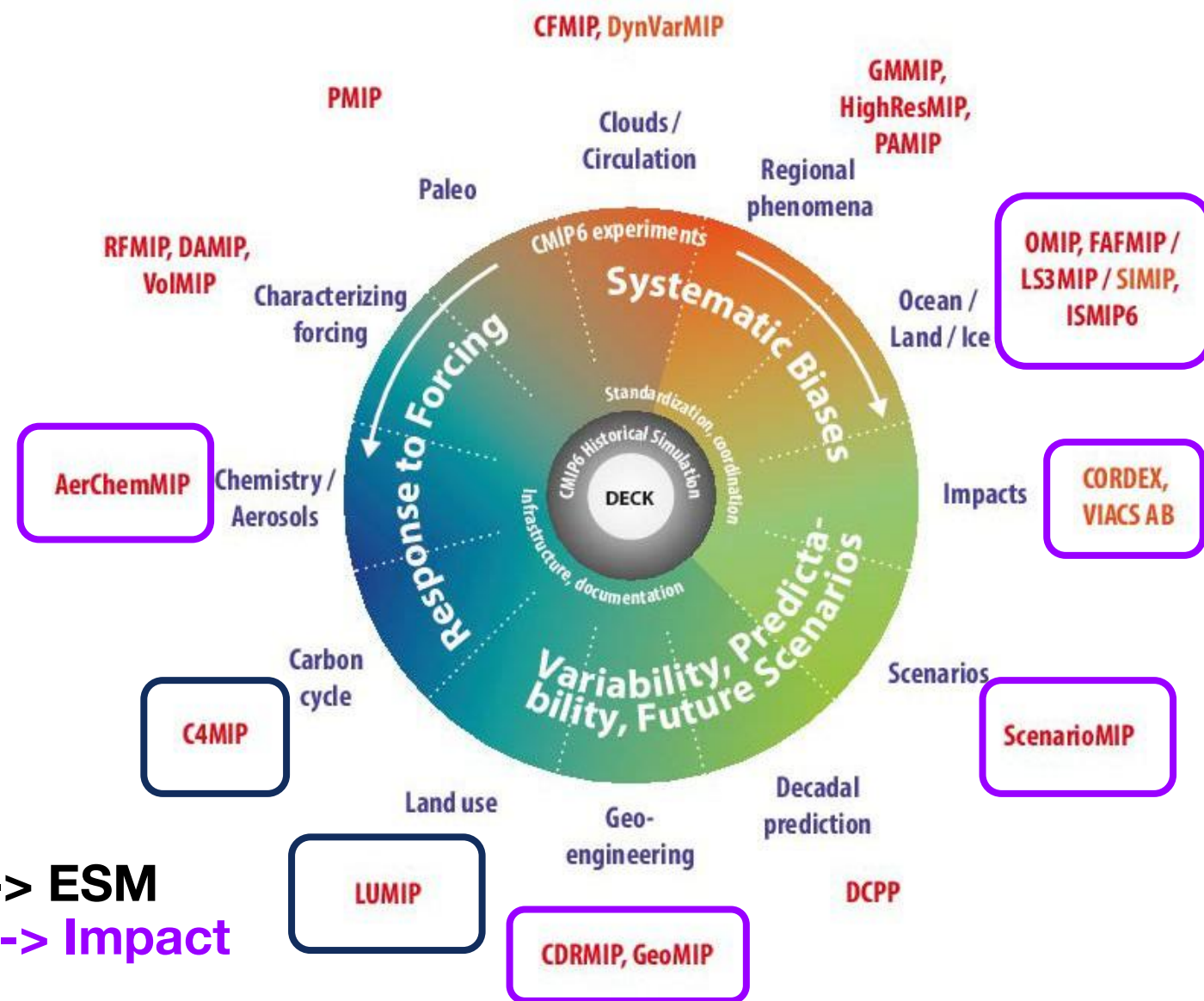
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## CMIP6



**IAM -> ESM**  
**ESM -> Impact**

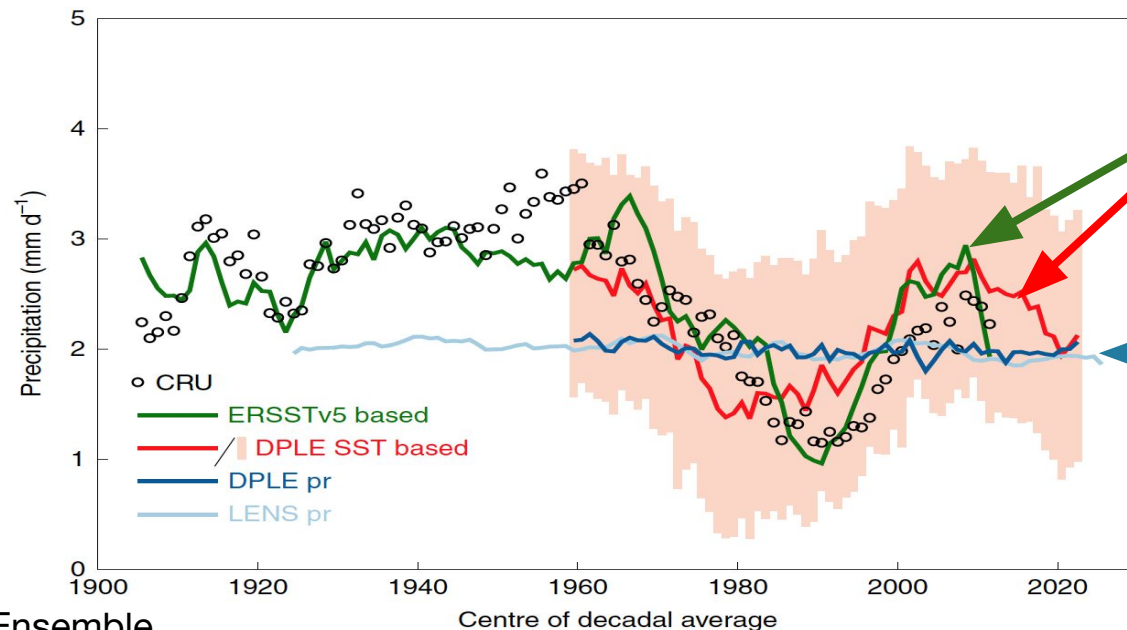
# Moving forward (next 5 years)

- Schism in climate modeling community
  - Very high (1-4 km) resolution to (hopefully) realistically simulate the necessary range of processes without (too many) parameterizations
  - Coarser (50-100 km) resolution to enable large ensembles

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Decadal  
average of  
March  
Precipitation  
over the UK



Precipitation from  
combined large-scale  
dynamics with obs-based  
downscaling pattern

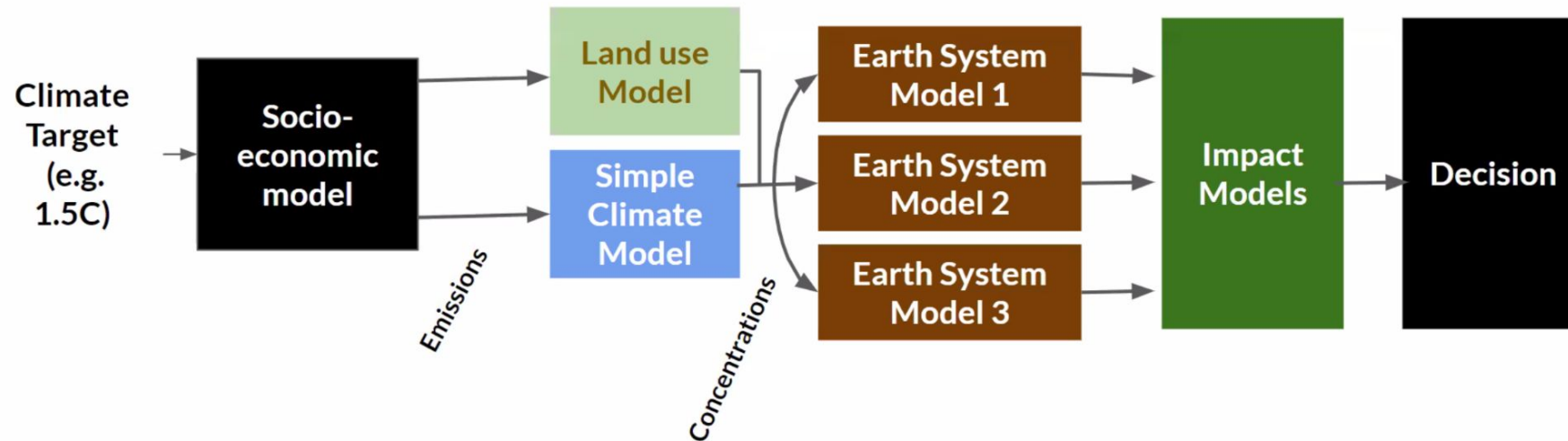
Explicitly  
simulated  
precipitation

DPLE: Decadal Prediction Large Ensemble

Simpson et al., *Nat. Geo.*, 2019

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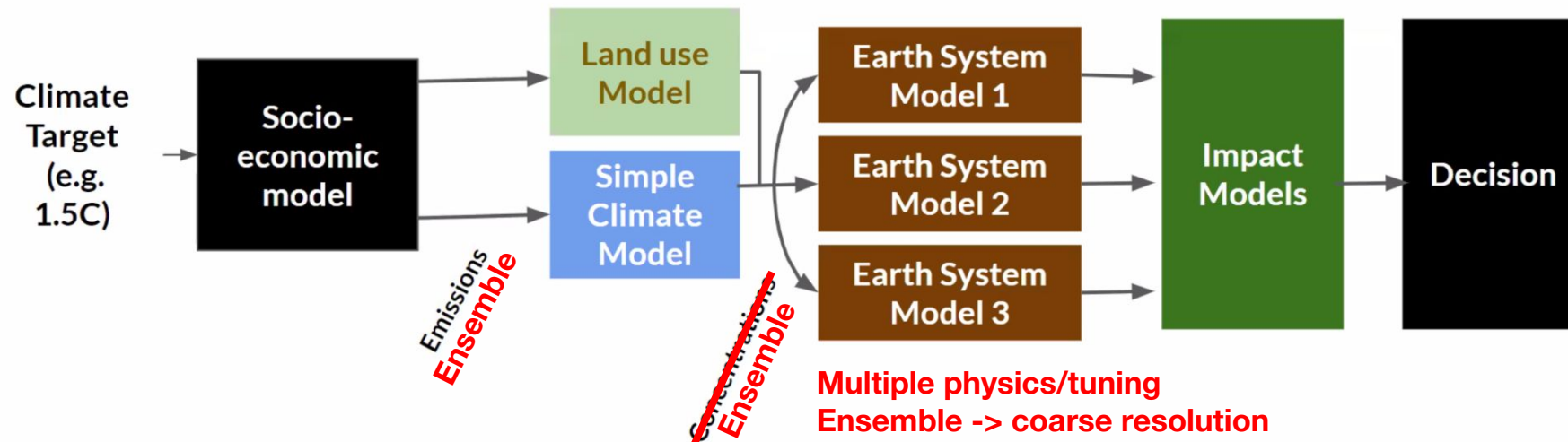
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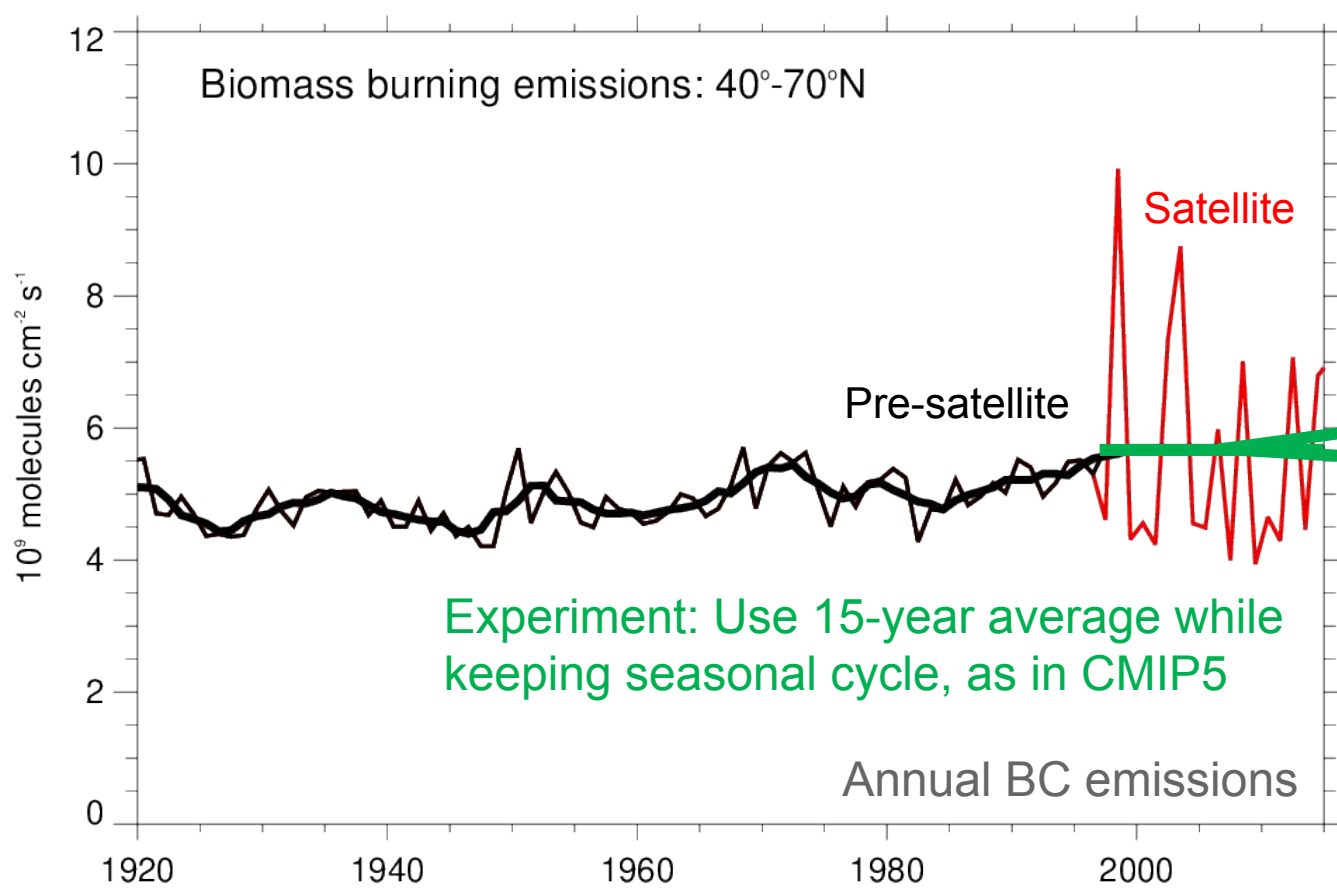


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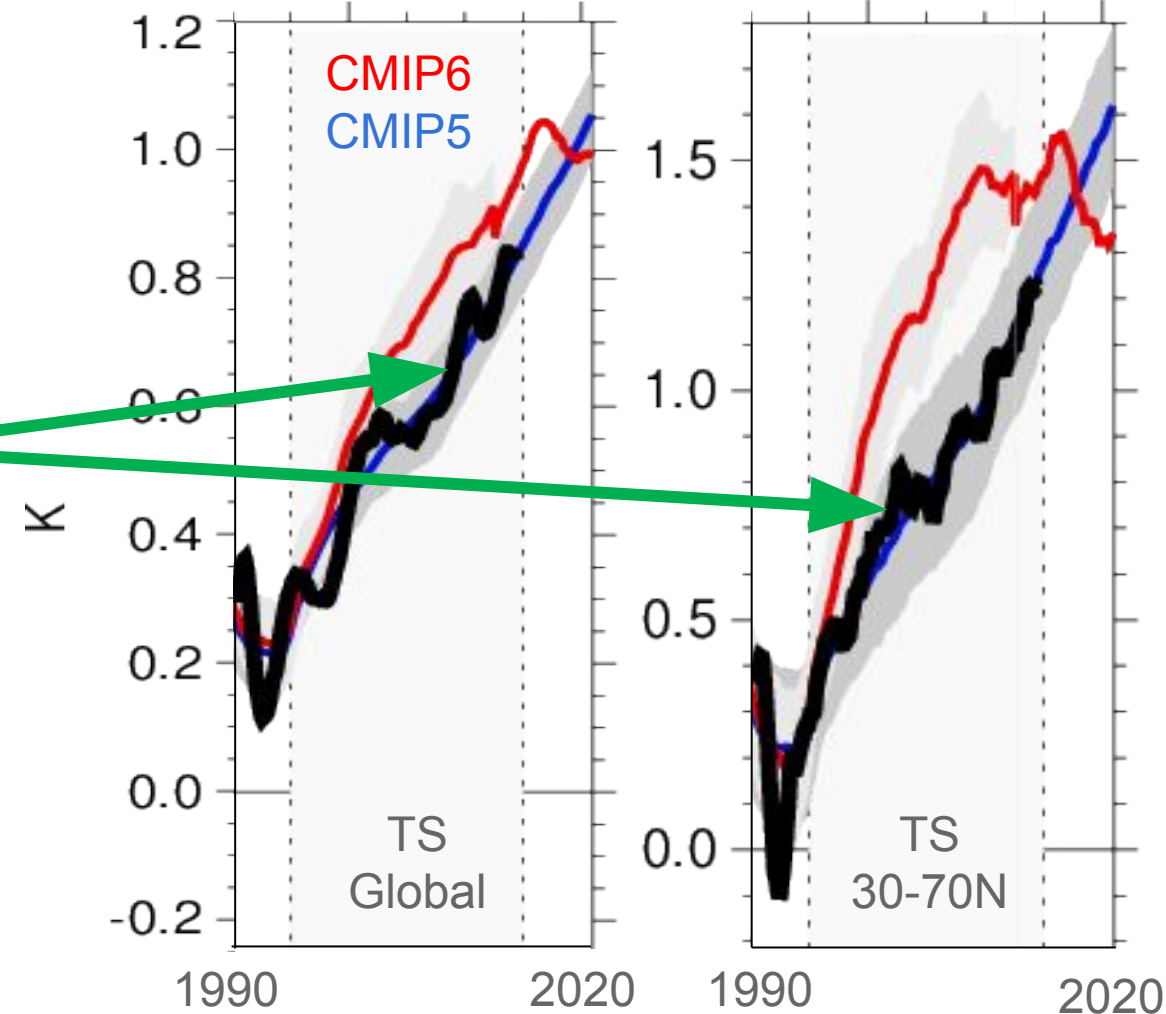
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# Recent warming and CMIP6 in CESM2



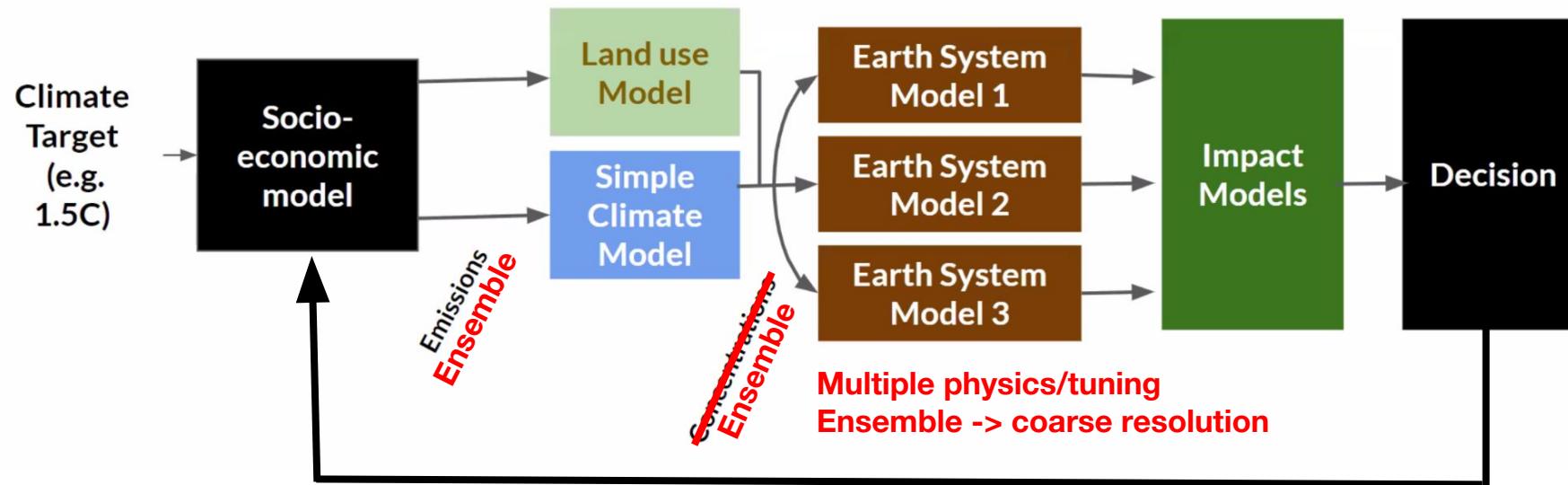
Because of the way it was constructed, the CMIP6 prescribed biomass (BB) emissions show a large increase in variability 1997-2014 (satellite based)



Fasullo et al., under review

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- Explicit coupling?



Do we need this in ESMs?

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- Explicit coupling?
- Stop thinking of one-size-fits-all
  - What is the question we are trying to answer? What is the best tool to answer it? -> build on CMIP infrastructure and standards
  - Not everything needs to be done with the full complexity ESMs -> a lot can be learned from a coarse resolution/simpler model
  - Duality of CMIP (science and impacts) needs to be recognized and should impact the design of MIPs and ESMs
  - Elephant in the room is computing power and storage. How can we optimize what we do (over 100 models!) while providing to the interested communities?

Questions?

Please answer the CMIP survey (coming soon)!